U.S. Environmental Protection Agency
Science Advisory Board
Air Quality Modeling Subcommittee (AQMS) of the
Advisory Council on Clean Air Act Compliance Analysis (Council)

Summary Minutes of Public Meeting
(May 4-5, 1999)

Committee: Air Quality Modeling Subcommittee (AQMS) of the Advisory Council on Clean Air Act Compliance Analysis (Council) of the U.S. Environmental Protection Agency's Science Advisory Board (SAB). (See Roster - Attachment A.)

Date and Time: Tuesday, May 4, 1999, from 9:00 a.m. to 5:30 p.m. and Wednesday, May 5, 1999, from 9:00 a.m. to 1:00 p.m. Eastern Time (See Federal Register Notice - Attachment B).

Location: SAB Conference Room M3709, 401 M Street, S.W., Washington, DC 20460, Washington, DC, 20007.

Purpose: To review background materials for the draft *Prospective Study: Report to Congress*, specifically the emissions inventories and air quality modeling that will be used as a basis for the Study. (See Meeting Agenda - Attachment C.)

Atttendees: Committee Members [Dr. Paulette Middleton,, Chair, Dr. Philip Hopke, Dr. Harvey Jeffries, Dr. Timothy V. Larson, Dr. Peter K. Mueller, Dr. James H. Price,- see Attachment A]; Dr. Angela Nugent (Designated Federal Official - SAB Staff). Speakers included Mr. James Democker (of the Office of Air and Radiation, EPA); Mr. Jim Wilson, (of Pechan Associates); Dr. Sharon Douglas (of ICF/SAI); Dr. Robin Dennis (of the Office of Research and Development, EPA); and Dr. Leland Deck (of Abt Associates). (See Meeting Sign-In Sheets for other Attendees - Attachment D.)

Meeting Summary:

The presentations and discussions at the meeting followed the issues and general timing as presented in the meeting Agenda, except where otherwise noted (see Meeting Agenda - Attachment C). The Agenda was structured to follow closely the charge questions submitted by the Agency (see Charge to the AQMS - Attachment E). There were no written comments submitted to the Committee, nor were there any requests made to present public comments during the meeting.

Welcome and Introductions - Dr. Paulette Middleton, Chair, opened the meeting at 9:00 a.m. welcoming members and consultants, and reviewed the meeting agenda

(Attachment C). Dr. Angela Nugent, Designated Federal Official for the AQMS reviewed the materials which had been provided to Committee. Then she requested that panel members introduce themselves and make a voluntary statement for the record regarding their research interests and experiences related to the review topic. No "particular matter" conflicts of interest were identified by the members or consultants.

Overview of Emissions and Air Quality Modeling for the Section 812 Prospective Study

Mr. James DeMocker presented an overview of the key issues for the AQMS. He outlined the six charge questions provided to the AQMS and how background material on those charge questions would be presented at the meeting by Agency Staff and contractors. He provided handout materials to complement his presentation.

He also summarized for the subcommittee several key issues raised by the Health and Environmental Effects Subcommittee (HEES) and the Council concerning the Section 812 Study. He reported that key issues for the HEES were: (1) ecological framework and methods for selecting endpoints for analysis; (2) ozone-related premature mortality; (3) particulate matter (PM) threshold sensitivity analysis; and (4) hazardous air pollutant analysis. Key issues for the Council from the last set of advice included: (1) the AQMS concern regarding primary PM emission inventories; (2) consideration of alternative paradigms for valuation of premature mortality; and (3) the HEES concerns regarding ecological benefits. The Agency will be addressing issues with the HEES at an upcoming meeting on June 28-29, 1999 and issues with the Council at its upcoming meeting with the Council on July 13-14, 1999.

Mr. Democker stated that the Agency was at a critical juncture in its air quality modeling work. It was just about ready to start benefit calculations based on its emissions and modeling work. He underscored that SAB advice has significantly shaped economic policies and procedures not only for the Section 812 analytical work, but also for the air programs' procedures and standards and for general economic analytical guidance now being developed by the Agency and provided to the SAB's Environmental Economics Advisory Committee for review

Mr. Democker then outlined the next steps in developing the Section 812 Study. He informed the AQMS that the Agency will most likely be required to meet its August deadline for delivering the final Report to Congress. He said that he would be developing a schedule for review of the draft Prospective Study that would allow for closure by the Council and inter-agency review.

Particulate Matter Emissions Inventories

Mr. Jim Wilson (of Pechan Associates) presented an overview of PM emission inventories. He provided a set of handout materials to complement his presentation. He presented the subcommittee with updated estimates of emission trends that adjusted base year (1990) emissions to track observed emissions more closely than previous emission inventories had indicated. Projections for the years 2000 and 2010 show that PM10 remains relatively constant. Among major components of PM emissions presented, he

projected: (1) some decreases in agricultural tilling and unpaved road emission; and (2) some increase due to expected increase in prescribed burning of forests.

The Subcommittee complimented the Agency on the improvement in emissions inventory estimates for PM10. Members noted a problem, however, in the information presented for PM 2.5, which also show trends as relatively constant. Members noted that the PM 2.5 emissions inventory: (1) is not showing the relative proportions of organic, elemental and crustal carbon in the air; and (2) may be missing large inputs from utilities, off-road vehicles and diesels. Members recommended that the Agency provide a breakout of the different species of PM2.5 and provide language in the Prospective Report that describes the limitations of the emissions data available and the implications of those limitations for the benefits assessment.

The Subcommittee also raised issues about the reliability of the Emissions Inventories' information on Volatile Organic Compounds (VOCs) and asked the Agency to make clear in the Section 812 Prospective Study assumptions and uncertainties associated with the Trends Report. The Subcommittee suggested that the recent National Acid Precipitation Assessment Program (NAPAP) provided a model for indicating the level of confidence placed in the data supporting the analysis provided. Mr. Democker suggested that the Prospective Study could include tabular format similar to that used in the Retrospective Study to indicate in each chapter the associated uncertainties and the significance of those uncertainties for the Prospective Study. The Subcommittee welcomed this suggestion.

Discussion then turned to how to improve the quality of information in the Emission Inventory. Members discussed the need to reiterate the recommendation made in their previous letter advisory (EPA-SAB-Council-Adv-98-002) that the Emissions Inventory be peer reviewed.

Overview of Air Quality Modeling

Mr. Democker introduced the topic, summarized emissions projection inputs, and contrasted the choice of models in the Retrospective and Prospective studies. He provided a set of handout materials to complement the presentations on this topic.

He showed how the Prospective Study's Emissions Inventory tracked concentration data for VOCs, nitrous oxides (NOx); sulphur dioxide; and carbon monoxide. He also showed how the Project Team had changed the methodology for calculating PM10 in 1990. Members emphasized that the Prospective Study needed to acknowledge published data on air quality other than those provided by EPA. Members agreed to provide the Agency with citations of studies they believe needed to be referenced in the Prospective Study and factored into the analysis presented.

Mr. Democker then presented a table comparing strategies for modeling pollutant exposures for different regions of the US in the Retrospective and Prospective Studies. For the Prospective Study, seven different modeling strategies will be used for different combinations of pollutants and regions.

Dr. Robin Dennis (of the Office of Research and Development, EPA) presented a briefing on the use of the RADM-RPM model for the Prospective Study. His presentation focused on Secondary PM, visibility, and acid deposition. He showed how the Study's use

of the model acknowledged differences with other models and compensated for special conditions, such as: (1) sulfates (important in the Eastern US; CASTNet data exist; RADM differs from CASTNet; indication of a non-linearity in how SO_4 relates to an SO_2 emission change); (2) nitrates (draft document uses NAPAP ammonia emissions inventory; concludes that its understanding of the physics of ammonia was better than the ammonium Emissions Inventory; adjusts for how nitrate competed with sulfate; adjusts the model for different seasons and different places on East Coast); and (3) visibility (shows absolute change, along with "some holes" where there are purchasers of sulfate rights; the Prospective Study will highlight that RADM model is based on the 1996 approach and doesn't include the Haze Rule, National Ambient Air Quality Standard revisions).

Dr Middleton asked about the status of work on Models 3, which will supercede the RADM-RPM model. Dr. Dennis stated that the model is on-line but that data sets are not available and the initial evaluation not done. The plan is for Models 3 to cover the lower 48 states and also some of Canada to address cross-boundary transport. Jim Democker indicated that the next iteration of the Prospective Study would use Models 3 if it is validated.

The Subcommittee noted that the results of the RADM-RPM model provided the basic information needed for the benefits assessment, even though it did not address sources of elemental carbon and secondary organics. The Subcommittee emphasized the need to use "plain language" in the Prospective Report and define clearly and consistently the meaning of such terms as "primary and secondary organics."

Sharon Douglas (of ICF/SAI) then described other air quality modeling methods and results. She described the analysis conducted at the recommendation of the AQMS to quantify model performance and examine how different modeling tools performed in different geographic areas at different times. For REMSAD, she concluded that: (1) there is a tendency for underestimation; (2) agreement generally good for the IMPROVE sites and good for sulfate and nitrate; (3) the results for the East generally show better agreement with observations; and (4) there are potential sources of error (model formulation, model inputs, and grid configuration/resolution).

Subcommittee members emphasized the importance of clearly stating in the Prospective Study the different geographic scales being modeled. The scale used will have implications for exposure and benefits assessments.

Air Quality Model-Derived Adjustment Factors

Dr. Sharon Douglas described the adjustment factors introduced to calibrate the model to observations. Members had several specific suggestions to improve how the Agency uses these factors and communicate about them. They recommended using the expression "sufficient for the analysis," when referring to data criteria, rather than the Quality Assurance term "complete." They also recommended communicating the calculation for data sufficiency clearly. The Subcommittee noted that adjustment factors for PM confirm a gross underestimation of emissions from diesel and non-road vehicles.

Homology Mapping Technique and Voronoi Neighbor Averaging (VNA)

Mr. Democker began the presentation by reminding the Subcommittee that there was a need to estimate baseline air quality monitoring data within some census tracts. The Retrospective Study had used RADAM baseline for monitoring and the AQMS had recommended that the Agency develop additional methods. In response, the Agency developed a multipoint spacial monitoring approach called VNA and has used it for the NOX SIP Call. This approach takes the estimated air quality from the nearest monitor locations. He asked the AQMS for help and advice on developing and refining the method.

Dr. Leland Deck (of Abt Associates) provided an overview of the VNA method. He provided a set of handout materials to complement the presentations on this topic. Committee members noted that the VNA method presented significant issues: (1) it ignored physical barriers (e.g., mountain ranges, other topography) that argue against deriving data from certain neighboring sites; (2) there were major data gaps in monitoring for some pollutants, such as ozone; and (3) ecological assessments could be distorted, in non-populated, non-monitored areas where VNA was required. Subcommittee members also noted that 81% of population reside within 50 miles of a monitoring site. Mr. Democker and Dr. Deck responded that the Council had requested full suite of monitoring data for the lower 48 states and that, in response, the agency needed to develop some method to derive data for the non-monitored sites.

Dr. Douglas then described an alternative approach, the Homology Mapping Approach, which uses known elements of the data set to derive missing elements. Using this approach, air quality data would be derived for a missing location by identifying a "homologue" that would match characteristics such as influence of urban areas, land use, latitude, elevation, and distance to nearest large body of water. Members indicated that the approach was promising, but that additional factors may need to be added, such as topography, climatic data, and wind direction.

The Subcommittee responded by noting that the Agency was on "thickest ice" by using air quality data for monitored sites covering 81% of population areas and then by adopting a method to derive data for the remaining areas, while explaining the limitations and assumptions associated with that method. Members suggested a variety of options for the Agency to consider: (1) the VNA approach; (2) model-based interpolation through validated grid cells; (3) using model output in an algorithm to apply to the nearest monitoring spot; and (4) using background estimates for non-monitored areas. The Subcommittee recommended that the Agency feature the uncertainties associated with any method chosen and emphasize the need for additional monitoring and research to improve data and methods.

The Subcommittee adjourned at approximately 5 p.m.

On Wednesday, May 5, 1999, the Subcommittee reconvened in a working session to address the charge questions.

In regard to Charge Question 1, "Are the input data used for each component of the analysis sufficiently valid and reliable for the intended analytical purpose?," members emphasized that the Agency needs to communicate the many assumptions implicit in the Emissions Inventory. They stated that the emissions trends are reasonable but there are

alternatives. One uncertainty underscored were the assumptions made about changes in the economy over the period 1990-2010. Members suggesting that there may be different and more robust techniques to employ to forecast economic trends for future Prospective Studies.

Members discussed again the need to have Emissions Inventories peer reviewed on a regular basis. They noted that Emissions Inventories were used for regulatory purposes other than the Section 812 Prospective Study. They have repeatedly observed that Inventories are not consistent with observations.

They discussed having the AQMS Advisory urge the SAB to initiate such a peer review. They also discussed having the Advisory recommend that the Prospective Report include a consolidated discussion of the relationship between observed trends and trends in the Emissions Inventories and the uncertainties associated with different Emissions Inventories. They agreed that the Agency's work on RADM-RPM and CASNET has substantially improved information on trends in ammonium nitrate and ammonium sulfate, sulfate, sulphur dioxide and nitrous oxide. They had much less confidence in Emissions Inventories on VOCs and PM Members called for a serious discussion of uncertainties, including "how currently available tools and data may have mislead the analysis."

The AQMS discussed VNA technique again. They discussed weighting the VNA average for non monitored sites by applying some weight influenced by model calculations, e.g., the ratio (model to monitor data for Voronoi neighbors) based on the modeled surface that would translate monitored data to non monitored point. They discussed the necessity for the Agency to implement an approach practical to the current Prospective Study that would maximize use of currently available information on air quality, and communicate uncertainties associated with the approach.

Dr. Peter Mueller asked Dr. Nugent to provide members of the AQMS and Mr. Democker with copies of material he thought would be of interest. He also asked Dr. Nugent to provide contact information for the *NAPAP Biennial Report to Congress: An Integrated Assessment*; *May 1998* in the record of this meeting. For extra copies of that report, contact NAPAP, NOAA @napap@noaa.gov.

The Committee scheduled its next teleconference for:

June 3, 1999, from 11 a.m. to 1 p.m., Eastern Time.

Topics: Methodology for Mapping Non-Monitored Sites, Presentation of Characterization of Uncertainties in the Prospective Study and Other Prospective Study Issues To Be Determined.

At 12:45 p.m. on Wednesday, May 5, 1999, Dr. Paulette Middleton adjourned the meeting.

Respectfully Submitted:

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(Name)
Designated Federal Official

Certified as True:

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(Name), Chair
Air Quality Modeling Subcommittee